



# META ANALYSIS: RENEWABLE ENERGY SOURCES

Kyle Lin

Research Scholars Program, Harvard Student Agencies. In collaboration with Learn with Leaders

## ABSTRACT

research has been conducted in recent years on the prospects of renewable energy sources as a result of the growing need for a long term, sustainable, and ecological friendly energy source. However, while these researchers have identified many individual factors that lead to the success of renewable energy companies and in turn innovation of renewable energy sources, they neglect to identify the interactions of these factors as well as the most optimized route to innovate renewable energy sources. This research paper will use the findings of previous researches to look at the big picture and find general trends of what causes renewable energy companies and thus renewable energy sources to succeed.

**KEYWORDS:** Renewable energy, fossil fuels, competitiveness, sustainability.

## INTRODUCTION

Society today has never relied so heavily on energy sources as it is currently. Observably, the fossil fuels that humans have relied on so heavily as an energy source is not sustainable in the long term and heavily damages the environment. It would ideal to replace fossil fuels with renewable energy sources like solar, hydro, or wind. This is a complicated process that would require great investment in terms of finances, energy, manpower and time.

Many studies and experiments have investigated individual factors that have prevented the replacement of fossil fuels and whether switching to renewable energy sources is worth the trouble. These factors include, the competitiveness of companies that use renewable energy resources, the immediate investments of using renewable energy sources, the return on investment, and what is needed to make the switch to renewable energy sources possible.

This research paper will be a collection of results on these factors as well as simulation of these factors in a realistic environment.

## Literature Review

*Comparison of the Financial Standing of Companies Generating Electricity from Renewable Sources and Fossil Fuels: A New Hybrid Approach*

Research by Tomczak and Sebastian Klaudiusz compares the use of renewable resources to traditional fossil fuels through their profitability. Due to restrictions and available data, the team could only gather information from Poland, Hungary, Slovakia, Czech Republic, Estonia, Latvia, Lithuania, and Slovenia which totaled 37 companies. Using each company's financial reports, the team carried out the ratio analysis, Altman model and the cluster, and Student's test. The conclusions of this research are that investing in the newer renewable resources for generating electricity would not be more profitable than the already existing electricity generator that use fossil fuels.

*Evaluation of the Economic Profitability of Using Renewable Energy Sources in Agro-Industrial Companies*

A study by Denis Syromyatnikov, Varvara Druzyanova, Aleksandr Beloglazov, Alexander Baksthanin, Tatiana Matveeva who stem from varying Russian federations aims to identify the impact of funding and the competitiveness of agro-industrial enterprises who use renewable energy sources. Thus, the team used a questionnaire survey to collect data on 20 Russian agro-industrial companies to identify the key indicators and how much they are integrated into an enterprise's competitiveness. After that, the team would find the level of energy-saving costs to form models that would then be used to help assess energy conservation costs by running the data through a regression analysis along with a hierarchical synthesis. The results of this study were that there was a close relationship between the availability of renewable resources and the competitiveness of a companies under this study while there was a direct relationship between the use of said renewable resources and the competitiveness of the companies. Furthermore, the team used this information to conclude that the correlation between energy conservation costs and the funding that is funneled into renewable energy has a decently strong correlation. Thus, the team concluded that funding and support for the use of renewable resources in agro-industrial enterprises do make renewable energy sources more efficient (especially as time passes). However, the companies in this study that were the most competitive also only stayed at the average level in terms of general competitiveness.

*The Potential of Using Renewable Energy Sources in Poland Taking into Account the Economic and Ecological Conditions*

An article by Mariusz Niekurzak was written about the prospects of renewable energy sources in Poland. To collect the data, the questionnaire method was used with the source of the data being the European Renewable Energy Center's database, interviews with users, and certain justified visits. With that data, a myriad of calculations and analyzes were carried out to find the return on investment over periods of up to 20 years as well as costs of reducing greenhouse gas emissions. Finally, conclusions such as the funding methods, prospects, pace of return investment outlays, optimal uses of each type of renewable energy source were made. Moreover, the study concluded that even without significant breakthroughs, renewable energy sources could supply 75% of Poland's energy demands. However, it was also found that current indirect support mechanisms are ineffective and more direct financial incentives such as subsidies would be needed for the renewable energy source industry until major breakthroughs occur.

## Data & Methods

This research relies on the data and conclusions of previous researches named above. With these data points and previously arrived conclusions, a meta-analysis could be done. This meta-analysis will focus on how the factors that were studied by these researchers interact with one another.

The meta-analysis will be done by comparing and contrasting each research's data and conclusions with one another to find any contradictions or recurring themes. Additionally, since all three individual researches yielded reliable data, the contradictions identified during the analysis must be due to the interactions of different factors.

However, since the nature of this research paper is to test the results of isolated factors against an unisolated and uncontrolled environment, the possibility of other unidentified factors affecting the results could be true. Thus, only strong correlations between individual factors should be noted (and be eligible for future research).

## Results

After considering the data from each research, it is obvious that certain patterns exist. For example, every research mentioned have concluded that the current methods of harnessing renewable resources are not more profitable than traditional fossil fuels. In some cases, using renewable energy sources proved to be less profitable than fossil fuels.

With that said, renewable energy companies that receive support from their respective governments tended to be more competitive in the energy industry and provide more energy than companies with less government support. Another common finding was that as the use of renewable resources continues, their efficiency and sustainability increases. In other words, in the long term, renewable energy companies would only become more beneficial and competitive than traditional companies that use fossil fuels because of factors such as availability of fossil fuels and the ecological effects of burning fossil fuels instead of the innate effectiveness or profitability of renewable energy sources.

Currently, energy companies that lack support from the government or other major investors usually were not competitive and were in financial distress.

Therefore, switching to renewable resources would force companies and governments to invest large sums of resources (both monetary and material) into an asset that is not profitable compared to traditional fossil fuels. Additionally, these researches also agree that renewable energy companies would not be able to supply a significant amount of energy for at least a few decades. For example, Poland's renewable resource shares being estimated to reach  $\frac{1}{3}$  by 2050 without any significant breakthroughs. However, in the case of Poland, coal mining would only be able to supply 60% of energy demands and domestic hard coal 20% in the most optimistic calculations by 2050 and is only set to decrease.

### Discussion

Similar to the conclusions of these individual research studies, the meta-analysis suggests that renewable resources are not significantly more profitable than fossil fuels even in the long term. On the contrary, the main reason why renewable resources would perform better than fossil fuels in the long term is because of the finite supply of fossil fuels as well as its ecological effects. Thus, renewable resources would not be able to overthrow fossil fuels in terms of efficiency and profitability but simply inherit the position. Along with the major amount of support that renewable energy companies need, these factors make switching to renewable energy sources very difficult.

This being the case, the switch to renewable energy sources is still extremely necessary as the supply of fossil fuels are beginning to deplete and the ecological effects of burning fossil fuels on a mass scale are being felt worldwide. Fortunately, it is repeatedly shown that as renewable energy companies gain more support and usage, the better they perform and the faster improvements are made.

Although this research identifies the general trends that are seen across the board with renewable energy, the exact interactions and importance of each factor is not identified. As mentioned previously, another research could be conducted that focuses on how two factors that produced or help to produce one of the general trends interact with each other in a controlled setting. The findings of that research could then be used to help optimize the growth of renewable energy sources and accelerate the switch from fossil fuels.

Furthermore, this meta-analysis could be further improved by subjecting the data of each research to the calculations of the other researches wherever possible to further verify the findings of each research. This would also help verify the general trends that were identified during this research.

### Conclusions

In conclusion, from the dependence on government support, to the relative unprofitableness of renewable energy sources to fossil fuels, the only benefit for a company to adopt renewable energy is to be labeled "eco-friendly." Consequently, the cost for setting up the equipment for harnessing renewable energy sources would simply be a large investment with little short-term return which further discourages companies from switching to renewable energy sources.

Nonetheless, renewable energy sources are essential to satisfying energy demands in the near future as well as minimizing ecological damage. Therefore, support for renewable energy sources such as government provided subsidies as well as other methods of financial support would allow renewable energy companies to continue innovating.

### REFERENCES

1. Niekurzak, M. (2021). The Potential of Using Renewable Energy Sources in Poland Taking into Account the Economic and Ecological Conditions. *Energies*, 14(22), 7525. <https://doi.org/10.3390/en14227525>
2. Syromyatnikov, D., Druzyanova, V., Beloglazov, A., Bakshatin, A., & Matveeva, T. (2021). Evaluation of the Economic Profitability of Using Renewable Energy Sources in Agro-Industrial Companies. *International Journal of Renewable Energy Development*, 10(4), 827–837. <https://doi.org/10.14710/ijred.2021.37908>
3. Tomczak, S. K. (2019). Comparison of the Financial Standing of Companies Generating Electricity from Renewable Sources and Fossil Fuels: A New Hybrid Approach. *Energies*, 12(20), 3856. <https://doi.org/10.3390/en12203856>